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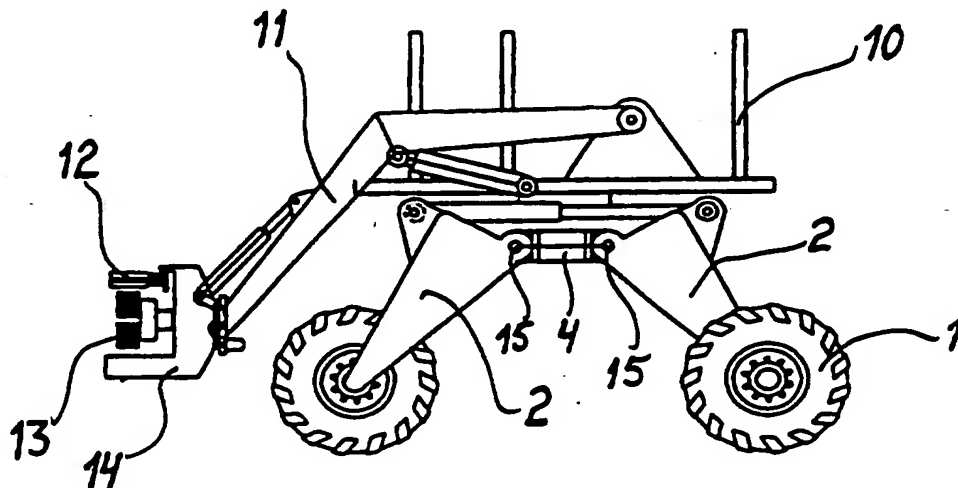
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(57) Abstract

With regulated ground clearance and wheel base equipped movable working machine, in which are placed a power source and steering devices for working and moving of the machine. The working machine consists essentially in the middle of the wheel base placed crosswise frame part (4), to which are formed shaft points (15) for fastening of the wheels (1) of the working machine to the mentioned frame part with turning arms (2), which arms are from their other end connected to shaft points (15) and to the other end of the arms has been connected with a bearing one or several wheels (1) of the working machine and that the working machine is self moving and remote controlled.

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## WORKING MACHINE

The invention relates to with own power source equipped remote controlled working machine, the ground clearance and wheelbase of which can be regulated and which is because of its characteristics suitable for harvesting in a forest.

Previously are known working machines with remote-control a.o. as moving machines used in mines and other dangerous circumstances. For regulation of ground clearance it is known different kind of suspension solutions, by means of which the frame of a vehicle or a working machine can be lifted higher. To regulate the wheel base in trailers there is known the shortening of the construction length of the trailer with lengthwise movable bogie or axle arrangements especially when the trailer is unloaded. Forest machines are built regarding their ground clearance so high that it is usually not necessary to regulate their ground clearance. Regulation of wheel base is known as a way to prevent sticking. A longitudinal telescope frame is used as help in a difficult terrain, in which case one of the axle systems of the machine can be pushed forward by lengthening the thelescope frame other axle systems being in their place, analogously by shortening the frame can the latter axle systems be pulled the previous one staying in its place.

With the working machine according to the invention can be reached surprising advantages and compound capacity to working performances, to moving ability of the working machine and to the regulation of the position of the working machine. Characteristic of the invention is that, what is presented in the characteristic feature section of the enclosed patent claims.

The most important advantages of the invention can be considered the accomplishment of a working machine with advantageous purchase price, which has good moving abilities in a difficult

terrain, wide range of functions and small own weight. Especially applied to harvesting the working machine according to the invention can almost in every case be driven beside the tree, we can do with it the felling and delimbing and other necessary cuts and also transport timber. With the new type of wheel support the working machine can be set to a horizontal position also on a sloping ground.

In the following the invention is closer explained by referring to the enclosed drawing, in which

Figure 1 presents the reduced frame construction of the working machine.

Figure 2 presents the frame laid down.

Figure 3 presents the working machine seen from the front.

Figure 4 presents the working machine from the front the frame laid down.

Figure 5 presents the working machine from the side with an extra device.

Figure 6 presents the working machine from the side the extra device turned.

Figure 7 presents the working machine seen from above.

Figure 8 presents the working machine with another extension.

Figure 9 presents the working machine according to figure 8 laid down.

Fig. 1 presents one example of the reduced frame construction of the working machine according to the invention. The working machine has four wheels 1, each of which are connected to arms 2. Arms 2 have been jointed to the frame part 4 so that every four arms has own shaft 15. With a cylinder 3, the example having two pieces, one on each side, arms 2 are turned, when a certain ground clearance or wheelbase is wanted. Cylinders on both sides are controlled separately. With this arrangement can the working machine easily be straightened on a sloping ground. So the side tilt of the working machine can be compensated. The arms 2 f.ex. on the side being seen in figure can be with a separate shaft mechanism forced to turn in regard to the frame part 4 always the same amount although only one cylinder 3 is being used. If the arms are wanted to have

deflection angle independent from each other, there should be two cylinders for them for each side. Frame part 4 is mostly crosswise in the middle of the working machine and to it is connected a power plant, a hydraulic unit, controlling devices and the actual tools and extensions. The distance between shafts can be varied and they can even be united in the middle to be the same shaft point. The regulation of the ground clearance and the change in wheelbase happens always at the same time.

In Fig. 2 the wheelbase has been lengthened by means of cylinder 3 to its maximum length and the ground clearance has been lowered to its minimum value.

In Fig. 3 the working machine being seen from the front is in the highest position as to its ground clearance and to it has been connected a harvester extension 5. In the extension 5 there is cutting and pruning end 6 as well as arms 7 to catch the timber. With the harvester extension 5 the tree is cutted down controlled, as the tree is after being cutted down supported by the working machine. The cutting down happens at different heights simply by bare regulation of the ground clearance when the working machine has been steered to the base of the tree. The extension 5 is fastened to the frame part 2 to turn upon the horizontal axis so that the extension turns on and below the frame. In both of these positions of the extension the timber can be transported by the working machine.

In Fig. 4 the frame of the working machine has been laid down to timber cutting position. With cutting device 6 at the harvester end the tree is cutted down at the wanted height usually as low as possible. The working machine is at the moment of cutting down steady, because the wheelbase is then largest.

In Fig. 5 the working machine is presented from side in felling situation. From the figure is being seen that the front wheels of the working machine are located even on the other

side of the tree being cutted down than the working machine itself. The working machine is steady and can then do a controlled cutting down even if it is a question of bigger trees. Together with the frame part 4 of the working machine is presented a power plant and a unit 8 including hydraulic machinery.

In Fig. 6 is presented the harvester extention 5 turned over the frame part 4. The tree cutted down is turned controlled with the support of catching arms 7 over the working machine. In this position are done the pruning and cuttings. At the harvester end 6 there is a feeding device, like rotating rollers, which carry the timber according to timber direction while pruning cutters delimb branches.

In Fig. 7 the working machine is presented from above. Wheels have hydraulic hub motors 9, with the help of which also the steering of the working machine happens by braking the engines on the turning side. Rail width is such that the harvester end 6 has space to work and move in the room between the wheels 1 and the arms 2.

Fig. 8 presents another form of harvester accessory. To the frame part 4 is attached also for timber transportation suitable with side poles 10 equipped space. Harvester part 14 is connected to the end of boom system 11 and the tree is cutted down with this device the same way as with known harvesters. At the harvester end there are transfer rollers 13 and delimbing cutters 12, which function also as support arms. The harvester end can be turned 180 degrees, which enables f.ex. taking a horizontally lying timber from the ground, lifting and turning the timber to loading space from upside. With this device the tree is cutted down away from the working machine and delimbed the boom 11 lifted up so high that the trees go through delimbing cutters 12 directly to loading space. The harvester part 14 is then hanging down from the boom 11.

In Fig. 9 the working machine is in felling position the frame laid down. With the device can even bigger trees be felled if the trees are always felled away from the working machine and the support is loosened during the felling.

The steering of the working machine goes most conveniently by using remote controllers. The controlling person has then a good view to any direction and building of a cabin in the working machine can be avoided. The working machine couldn't be accomplished advantageously if a steering cabin should be placed in it. Working with this working machine is no more dangerous than using a chain saw, because a falling tree must be looked out in both cases. The working machine is safer in that way that with it can hung trees be loosened from an appropriate distance. The working machine is therefor also well suited for harvesting in storm destruction area. For wheel support has been developed a progressive way, which gives the working machine a good stability, the fixing of tilt can be done according to terrain and sticking can be avoided. These results we get simply by supporting the wheels to shaft arms 2.

In the working machine is placed a combustion engine having appr. 30 kW effect. For power transmission is used a hydraulic system, with electrically working valves, and remote controlling functions in the known way.

Moving of the working machine can be remarkably improved by installed half bands, the support wheel of which is installed in front of the front wheels and connected to an arm 2 so that the support wheel is lowered to the level of the real front wheel 1 when the arm 2 is turned to the shortest position of wheelbase. This is a driving position in a soft country. Accordingly by lengthening the wheelbase the support wheel rises higher and helps in crossing the obstacles.

Rail width can be regulated in one form of the performance by regulating the distance between fastening points of the arms 2 in frame 4.



The working machine according to the invention is especially well suited to be in a terrain moving piledriver, drilling machine, at the roadside moving working machine, in which case it is not as a slow machine in the way on driveway as well as a.o. it is suitable to mines and as a working machine with an excavator or a bucket loader equipment.

## CLAIMS

1. With regulated ground clearance and wheelbase equipped movable working machine, in the frame (4) of which has been placed a power source (8) and which working machine consists steering devices for working and moving and the wheels (1) of which have been placed to be supported by arms (2), which are jointed from the other end to be turnable in regard to the frame (4), the frame (4) being placed essentially in the middle of the wheel base, characterized in that separately on both sides of the working machine, the arms (2) of the sides are combined to turn by using one regulating unit (3) and independently on the movement of the regulating unit (3) on the opposite side to accomplish ground clearance or side tilt of different size between the sides of the working machine.
2. A working machine according to claim 1 characterized in that the working machine is self moving and remote-controlled.
3. A working machine according to claim 1 or 2 characterized in that the length of the wheel base can be separately regulated on both sides of the working machine.
4. A working machine according to one or several claims 1 - 3 characterized in that rail width of the working machine can be regulated by regulating the distance of the fastening points of the arms (2) in the frame (4).
5. A working machine according to one or several claims 1 - 4 characterized in that in the frame part (4) there are fasteners for fastening a tool or an extension to the working machine.
6. A working machine according to one or several claims 1 - 5 characterized in that to the frame part (4) can be fastened a harvester (5), (11,12,13,14) ment to cut, delimb and load timber.

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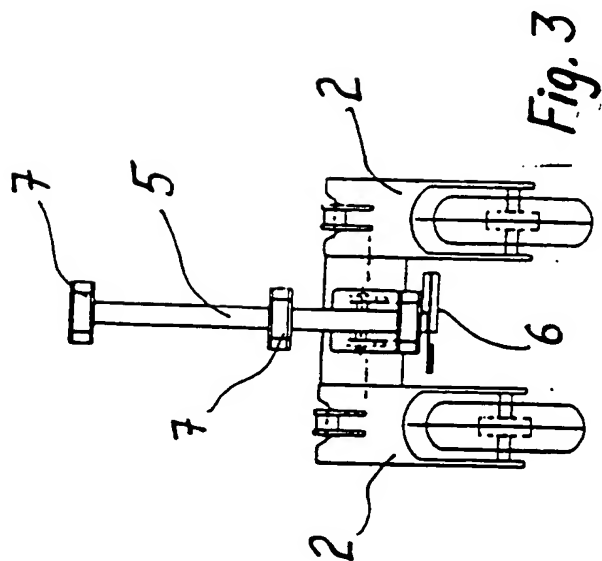
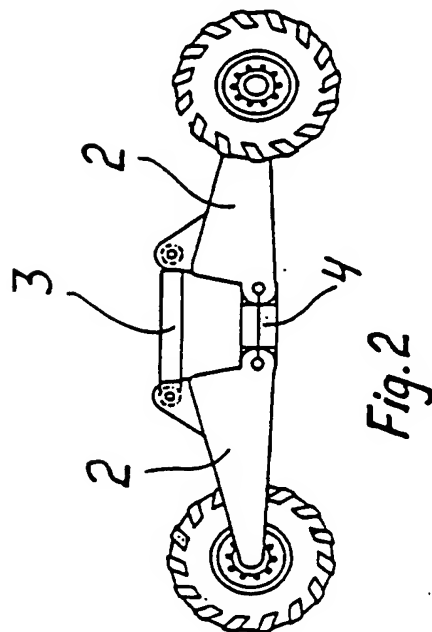
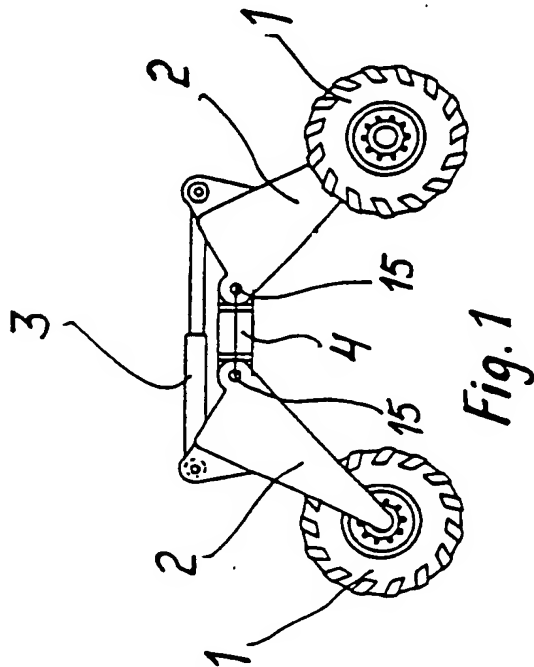
7. A working machine according to one or several claims 1 - 6 characterized in that on the frame part (4) there is a load carrying, limited space.

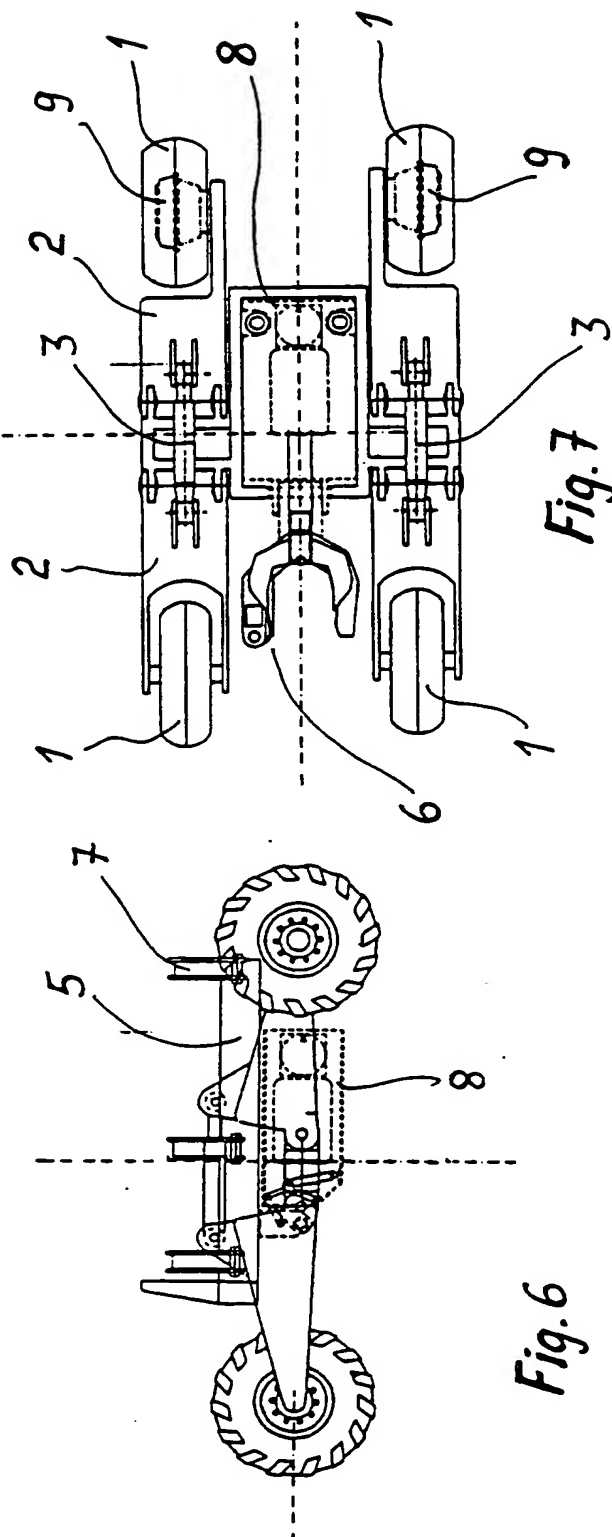
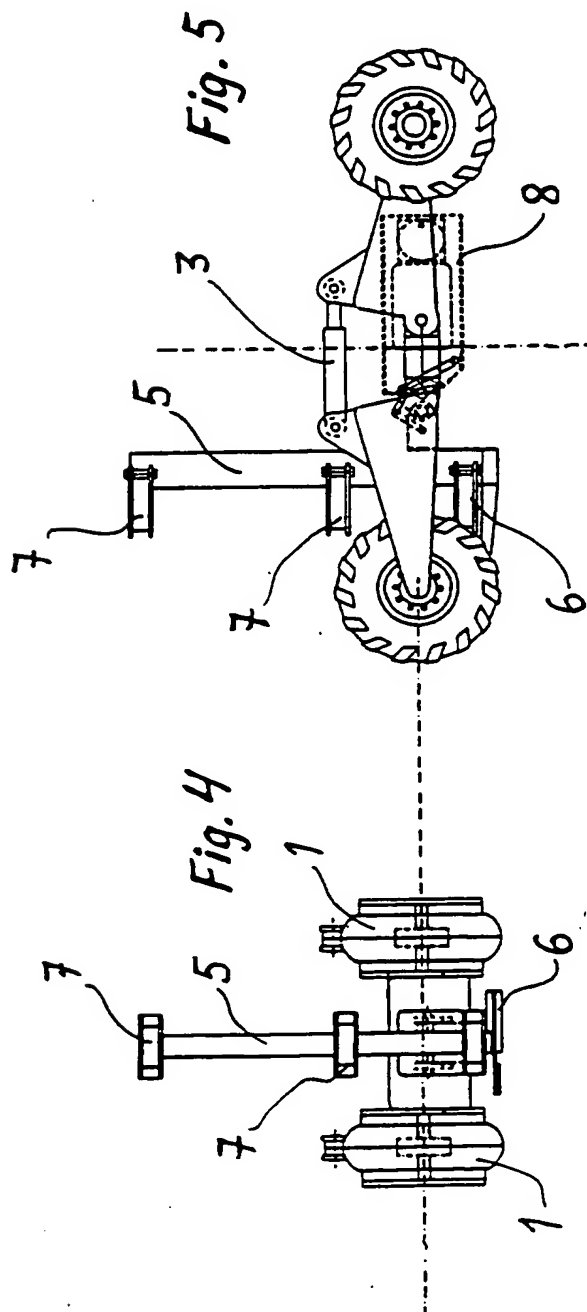
8. A working machine according to one or several claims 1 - 6 characterized in that the load, as timber, can be transported under the frame part (4) in the space between wheels supported by harvester end (6), (12) equipped with loading ability.

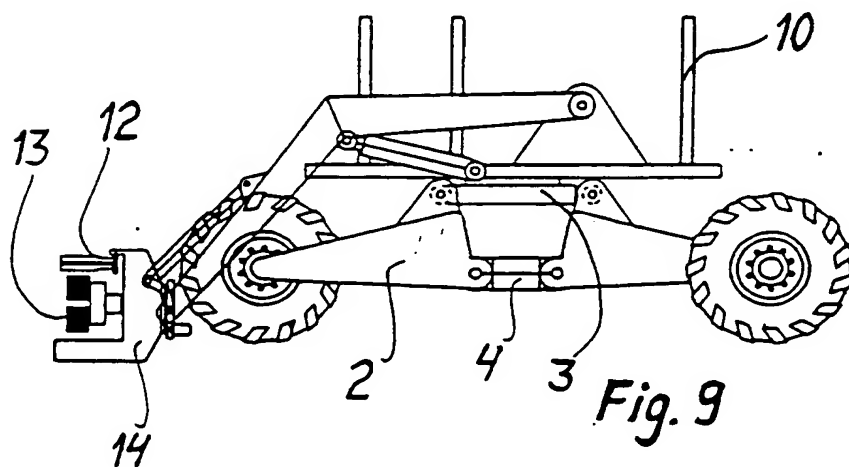
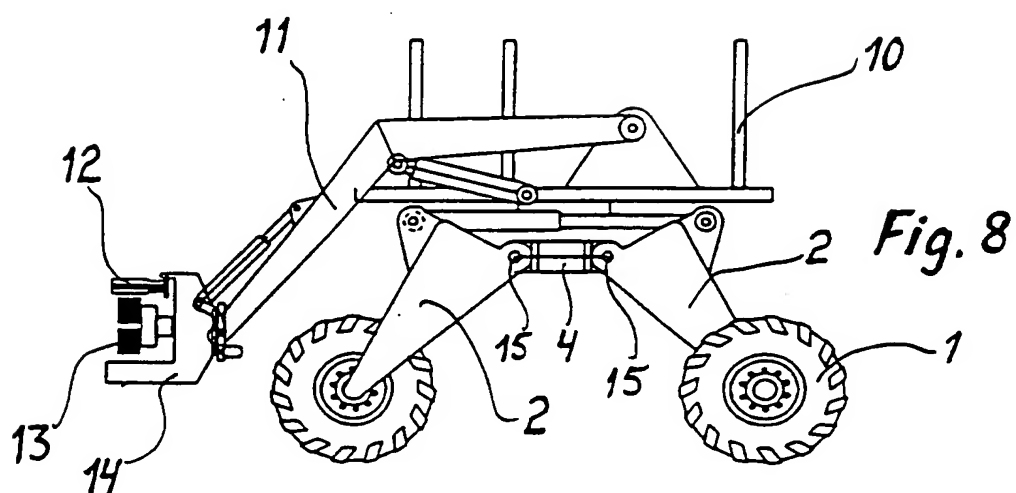
9. A working machine according to one or several claims 1 - 8 characterized in that in connection with the frame part (4) there is a driving motor and a unit (8) producing hydraulic pressure energy.

10. A working machine according to one or several claims 1 - 9 characterized in that the wheels (1) have hub motors (9).

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# INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 94/00420

## A. CLASSIFICATION OF SUBJECT MATTER

IPC6: A01G 23/08, B62D 61/00

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: A01G, B62D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO, A1, 9210390 (ERIKSSON, PETER), 25 June 1992 (25.06.92), page 4, line 23 - page 5, line 16, figures 1-8 --	1,3,5,6,9,10
X	US, A, 4090723 (HART), 23 May 1978 (23.05.78), figures 1-3, abstract --	1,3,5,9
X	US, A, 4602800 (PERSSON), 29 July 1986 (29.07.86), column 2, line 19 - line 25, figure 1 --	1,3,9
A	Derwent's abstract, No 87- 84779/12, week 8712, ABSTRACT OF SU, 1246944 (UKHTINSKIND INST), 30 July 1986 (30.07.86) --	1-10



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\* C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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A	FI, B, 73352 (MARTTI JOHANNES KÄÄRIÄINEN), 6 May 1987 (06.05.87), figures 1-2 --	1-10
X	SE, B, 463812 (HELGE RÄDSTRÖM), 17 June 1988 (17.06.88), page 5, line 18 - line 27, figures 1-7 -- -----	1,3,4,7,9,10



# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/FI 94/00420

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO-A1- 9210390	25/06/92	SE-B,C- 467966 SE-A- 9003900	12/10/92 08/06/92
US-A- 4090723	23/05/78	NONE	
US-A- 4602800	29/07/86	AU-A- 2864284 EP-A,B- 0151125 JP-T- 60501155 SE-B,C- 448293 SE-A- 8302393 WO-A- 8404284	19/11/84 14/08/85 25/07/85 09/02/87 29/10/84 08/11/84
FI-B- 73352	06/05/87	NONE	
SE-B- 463812	17/06/88	SE-A- 8605435	17/06/88